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ABSTRACT

This booklet, one of six in the Living Things Science series, presents activities about cells which address basic "Benchmarks" suggested by the American Association for the Advancement of Science for the Living Environment for grades 3-5. Contents include background information, vocabulary (in English and Spanish), materials, procedures, extension activities, and worksheets. The worksheets are presented in both English and Spanish versions. Suggestions for use of the activities include using student grouping, a related readings center, and journal keeping. Activity names are: "Building Blocks," "Magnifiers and Microscopes," "Plant and Animal Cells," "It's All Here," "Create-A-Cell," "On the Move," "Passing Through," "A Day in the Life of Chris C. Cell," "Living in the Colonies," and "What Does What?" An appendix contains illustrations of sample plant animal cells, and lists of fiction and non-fiction readings. (MKR)

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ED 392 639

INVITATIONS TO CELLS

LIFE'S BUILDING BLOCKS

Hands-on Laboratory Science Activities

with reproducible handouts in English and Spanish

Grades 7-12

Middle School Edition

SCIENCE TEACHING RESOURCE SERIES

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INVITATIONS

TO

CELLS:
LIFE'S BUILDING BLOCKS

Teacher-Friendly Science Activities

with reproducible handouts in English and Spanish

Grades 3-5

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LIVING THINGS SCIENCE SERIES

Ash Grove Press, Inc.

LIVING THINGS SERIES

Life's Diversity

Heredity: Generation to Generation

Cells: Life's Building Block

Interdependence: Caught in the Web

The Matter-Energy Cycle

Evolving

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TABLE OF CONTENTS

Introduction		1
Related Reading for Invitations Center		3
Vocabulary		4
Invitation 1	BUILDING BLOCKS	7
Invitation 2	MAGNIFIERS AND MICROSCOPES	10
Invitation 3	PLANT AND ANIMAL CELLS	13
Invitation 4	IT'S ALL HERE	19
Invitation 5	CREATE-A-CELL	27
Invitation 6	ON THE MOVE	28
Invitation 7	PASSING THROUGH	33
Invitation 8	A DAY IN THE LIFE OF CHRIS C. CELL	35
Invitation 9	LIVING IN THE COLONIES	37
Invitation 10	WHAT DOES WHAT?	39
SAMPLE PLANT AND ANIMAL CELL		40
Science Journal Handouts		41

INVITATIONS

CELLS: LIFE'S BUILDING BLOCKS

INTRODUCTION

All living things are made up of small individual units called cells. A cell is the smallest unit that can carry on all of the activities of life. Some organisms consist of one cell, while others consist of billions of cells. These cells are essential to continued life and require many of the same necessities that the larger organisms require. It is difficult to imagine that an organism the size of a human being is comprised of millions of billions of cells. It is also important to realize that it does not matter whether the organism consists of one cell, many cells, or billions of cells, the basic functions required for survival are similar for all organisms. For example, all organisms need nourishment.

In a single-cell organism, all functions are carried out by that one cell. In a multicellular organism, cells begin to specialize and work together to carry out individual functions.

One of the primary concepts for students in grades 3-5 suggested by the American Association for the Advancement of Science requires microscopes. Several of these INVITATIONS have been designed to include the use of microscopes. If microscopes are unavailable in your classroom setting, try borrowing some from the science teachers in your school system. If you have a college or university in your area, they may be willing to loan you some microscopes that they no longer use. It is important to acquire as many microscopes as possible, so each student will have easy access to the equipment. It is not necessary to have high-powered microscopes, but rather easy to use child-appropriate microscopes.

If microscopes are not easily accessible to you, use whatever tools you have available for magnification, such as magnification glasses, *bug* boxes, or other magnification tools available through science equipment supply companies.

By third grade, students should already understand that instruments such as microscopes and magnifiers assist people in seeing things that they cannot see unaided. Students should already understand that most living things require food, water, and air to survive.

Due to the nature of the interdependence of all things, the INVITATIONS in this book address all of the following concepts at some level. However, some invitations highlight one or more of the concepts. Those concepts will be identified by bold print in the concept section of each INVITATION.

CONCEPTS

- Some living things consist of a single cell.
- Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

SCIENCE JOURNAL

The students are encouraged to keep journals of their observations. They are also encouraged to reflect on these observations as they begin to develop their own understanding of cells. The students can create their own format for their science journals, or the teacher can suggest a format or use the reproducible pages throughout this book.

CLASSROOM MANAGEMENT

The activities in this INVITATION can be managed in a variety of ways. However, students should have many opportunities to work together in groups of 3-4 students. By sharing and working together, students will be able to value their fellow students contributions, as well as begin to realize that the

process that they are engaged in is similar to the one scientists use in order to understand these concepts.

If it is possible in your classroom, identify one area, desk, or table, as "INVITATIONS to Cells: Life's Building Blocks." In this center include books from the resource list and extension activities.

Some aspects of these invitations are more appropriate for the younger students, while other aspects are better for older students. Teachers should feel free to adapt each activity for their particular students.

SIZE OF THINGS

All sizes are approximate.

Hydrogen atom	0.1 nanometer
Diameter of DNA double helix	1 nanometer
Cell membrane	10 nanometers
Large virus	100 nanometers
Lysosomes	1 micrometer
Human milk-secreting cell	10 micrometer
Human egg	100 micrometers
Frog's egg	1 millimeter
Hen's egg	100 millimeters
Some nerve cells	1 meter

RELATED READING FOR INVITATION CENTER

Allison, Linda. *Blood and Guts.* Boston: Little, Brown & Company, 1976.

Anderson, Lucia. *The Smallest Life Around Us.* New York: Crown Publishers, 1987.

Asimov, Isaac. *How Did We Find Out About Germs.* New York: Walker and Company, 1974.

Atlas of Anatomy. Horton, Casey, Ed. Sycaucus, NJ: Charwell Books, Inc., 1985.

Balestrino, Philip. *The Skeleton Inside You.* New York: Harper & Row, Publishers, Inc., 1989.

Barnard, Christian. *Junior Body Machine.* New York: Crown Publishers, 1983.

Brain and Nervous System. Philip Steele, Ed. Englewood cliffs, NJ: Schoolhouse Press, Inc., 1988.

Cole, Joanna. *Cuts, Breaks, and Burns: How Your Body Heals.* New York: Crowell, 1985.

Cole, Joanna. *Your Insides.* New York: Putnam & Grosset, 1992

Dareff, Hal. *The First Microscope.* New York: Parent's Magazine Press, 1962.

Elting, Mary. *The Human Body.* New York: Macmillan Publishing Company, 1986.

Fisher, Leonard. *Galileo.* New York: Macmillan Publishing Co., 1992.

Fitcher, George. *Cells.* New York: Franklin Watts, 1986.

Freeman, Dan. *Beautiful Bodies.* New York: Peter Bedrick Books, 1983.

Kumin, Maxine. *The Microscope.* New York: Harper & Row, Publishers, 1984.

O'Neill, Catherine. *How & Why: A Kid's Book About the Body.* Mount Vernon, NY: Consumers Union, 1988.

Parker, Steve. *How Nature Works.* New York: Random House, 1993.

Parker, Steve. *The Body and How It Works.* New York: Dorling Kindersley, 1992.

Parramón, Mercé. *The Digestive System*, New York: Chelsea House Publishers, 1994.

Richardson, Joy. *What Happens When You grow?* Milwaukee: Gareth Stevens Publishing, 1986.

Schultz, Ron. *Looking Inside the Brain.* Santa Fe: John Muir Publications, 1992.

Schneider, Leo. *You and Your Cells.* New York: Harcourt, Brace and the World, Inc., 1964.

Silverstein, Alvin and Virginia Silverstein. *A World in a Drop of Water.* New York: Atheneum, 1969.

Skin, Hair, and Teeth. Philip Steele, Ed. Englewood Cliffs, NJ: Schoolhouse Press, Inc., 1988.

Stein Sara. *The Body Book.* New York: Workman Publishing, 1992.

The Brain and Nervous System. Philip Steele, Ed. Englewood, NJ: Schoolhouse Press, Inc., 1988.

Wohlrabe, Raymond. *Exploring the World of Leaves.* New York: Thomas Crowell Company, 1986.

VOCABULARY

The teacher is encouraged to help students develop their own unique sets of vocabulary words depending on the students interest, experience, and ability. The following words are primarily for the teacher.

amoeba: a single cell protozoa which perpetually changes its shape. It nourishes itself by enveloping minute organisms and fragments of food.

amiba: un protozoario de célula única que cambia perpetuamente su forma. Se alimenta envolviendo organismos y framentos diminutos de alimento.

cilia: tiny hairlike projections of cytoplasm

cilia: proyecciones de citoplasma minísculos

cell membrane: the cell part that gives the cell shape and holds the cytoplasm

membrana de célula: la parte de la célula que rodea el citoplasma y le da forma

cell: smallest unit that can maintain life's processes

célula: la unidad mas pequeña que puede mantenar procesos de vida

cell wall: firm covering that encloses and supports most plant, fungal, bacterial, and some protist cells.

pared de célula: la cubierta firme que incluye y sostiene la mayoría de células de planta, de hongo, de bacteria, y de algunas células protistas.

cellular respiration: the way in which living things obtain energy from food molecules.

respiración celular: la manera en que seres vivos obtienen energía de moléculas de alimento.

centriole: those parts of the cell that help with reproduction

centriole: aquellas partes de la célula que ayudan a la reproducción

chloroplast: organelles of plants and protists that produce carbohydrates

cloroplasto: sistemos orgénicos de plantas y de protistas que producen carbohidratos

chromosome: threadlike structures formed in the cell during mitosis that contain DNA

cromosoma: estructuras filiformes formadas en la célula durante mitosis y que contienen DNA

colony: a group of similar cells that are attached to each other

colonia: un grupo de células similares que estan agregados unos a los otros

cytoplasm: inner material of the cell which contains all the components for its life

citoplasma: el material interior de la célula que contiene todos los componentes para su vida

diffusion: movement of molecules from a region of higher to lower concentration

difusión: el movimiento de moléculas de una regió de mas concentración a una de menos concentración

euglena: an oval shaped protozoa which swims by means of a flagellum at the anterior end

eukaryote: organisms whose cells contain a membrane-bound nucleus and membrane bound organelles

flagella: whiplike structures found on some cells used for locomotion

hydra: fresh water polyp having a single body opening surrounded by tentacles

mitochondria: energy producing cell parts

motile: capable of locomotion

nuclear membrane: a thin layer of living material that surrounds the nucleus

nucleolus: the part of the cell that produces ribosomes

nucleus: the cell part that controls most of the cell's activities and which contains most of the DNA

organ: different tissues that are grouped together to perform a function or which function as a unit

organelles: subcellular part that has a special cellular function such as a ribosome

organism: any living thing

osmosis: the process by which water moves through a membrane from an area of low solute concentration to an area of high solute concentration.

euglena: un protozoario ovalado que nada por medio de un flagelo en el extremo anterior

eukaryote: los organismos cuyas células contienen un núcleo y sistemos orgánicos rodeados por membranas

flagela: estructuras encontradas en algunas células y utilizadas para locomoción

hydra: un pólipo de agua dulce que tiene solamente una apertura rodeada por tentáculos

mitocondria: las partes de la célula que producen energía

móvil: capaz de locomoción

membrana nuclear: una capa delgada de materia viviente que rodea el núcleo

nucleolus: la parte de la célula que produce ribosomas

núcleo: la parte de la célula que controla la mayoría de las actividades de la célula y que contiene la mayoria del DNA

órgano: unos tejidos que están agrupados juntos para cumplir una función o que funcionan como una unidad

organeles: parte subcelular que tiene una función especial tal como la de un ribosome

organismo: cualquier ser vivo

osmosis: el proceso por medio del cual el agua se mueve de un area de concentración baja en una sustancia disuelta a un area de concentración alta

paramecium: complex, oval shaped, protozoa which moves by means of hairlike cilia which also sweep particles of food back toward the mouth pore

paramecio: un protozoario complejo de forma ovalada que se mueve por medio de cilia y que tambien barre partículas de alimento hacia los poros de la boca.

prokaryote: organism which lacks a true nucleus and which reproduces by splitting

prokaryote: organismo al cual que le falta un núcleo verdadero y que se reproduce por división

pseudopod: projection of the cell body which is used for movement or feeding

seudópodo: una proyección del cuerpo de la célula que es utilizado para movimiento o alimentación

ribosome: cytoplasmic body that produces proteins for the cell and which contains RNA

ribosoma: una substancia citoplásmica que produce proteínas para la célula y que contiene RNA

sessile: an animal that lives attached to another object, such as a sponge

sessile: un animal que vive pegado a otro objeto, por ejemplo la esponja.

tissue: a group of cells that have a similar structure and similar activities

tejido: un grupo de células que tienen una estructura similar y actividades similares

vacuole: cavity in a cell surrounded by a membrane that serves as a storage area. It may function in digestion, secretion or excretion.

vacuola: la cavidad en una célula rodeada por una membrana que sirve como area de almacenamiento. Puede funcionar en la digestión, secreción o excreción

INVITATION 1

BUILDING BLOCKS

CONCEPTS

- Some living things consist of a single cell.
- Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

The basic structural unit of life is the cell. A cell is the smallest unit that can carry on all of the activities of life. All living things are made up of cells. A human body contains about 100 trillion cells. Cells that perform similar functions tend to be similar in size and shape. The range of cell size is enormous. Some cells, like nerve cells, can be as long as a meter, and still be invisible to the naked eye. Some cells, like viruses, can be seen only through electron microscopes. The yolk of a chicken egg or an ostrich egg is only one cell. This invitation is designed as an introduction to the concept of cells as building blocks.

MATERIALS

- Cubes at least 1 inch on each side
- Cubes about 1 centimeter on each side
- Salt crystals
- Chart page 8 or 9

PROCEDURE

1. Give each group of students as many of the larger blocks as possible.
2. Tell students to make believe that one of the large blocks represents an ant. Invite students to predict how many blocks it would take to make a worm, if one block equaled an ant. Have students come to consensus in their groups. When consensus is reached, have students make a worm. Groups do not have to agree with each other, but members of each group should be satisfied with the number agreed upon by their group.
3. Continue process using worm, mouse, collie dog, human, horse, elephant, and whale. It is not necessary to use these particular organisms, as long as each organism selected is larger than the proceeding one. Eventually, it will become impossible to create the larger organisms with the blocks because of space and supply issues.
4. Repeat steps 2 and 3 with centimeter cubes, but this time have students make believe that an ant is made of 10 blocks.
5. Repeat process using salt crystals. Tell the students to make believe that an ant is made up of 100 salt crystals. Continue process as before. Instead of counting, students may suggest some process for measuring; for example, using a 1/4 teaspoon of salt to represent 100 crystals.
6. Ask students to imagine a block smaller than salt so small that they can't see it with the naked eye.
7. Invite students to draw a picture of what they think this block might look like through a microscope.
8. Explain to students that all living things are made up of blocks called cells.

EXTENSION ACTIVITIES

- Write a story about a world where the building blocks of all living things are the size of shoe boxes.

BUILDING BLOCKS

Scientist_____

ORGANISM	PREDICTION If ant = 1 large block	PREDICTION If ant = 10 small blocks	PREDICTION If ant = 100 salt crystals
WORM			
MOUSE			
COLLIE DOG			
HUMAN			
HORSE			
ELEPHANT			
WHALE			

BLOQUES DE CONSTRUCCIÓN

Científico_____

ORGANISMO	PREDICCIÓN Si hormiga = 1 bloque	PREDICCIÓN Si hormiga = 10 bloques	PREDICCIÓN Si hormiga = 100 cristales de sal
GUSANO			
RATÓN			
PERRO COLLIE			
HUMANO			
CABALLO			
ELEFANTE			
BALLENA			

INVITATION 2

MAGNIFIERS AND MICROSCOPES

CONCEPTS

- Some living things consist of a single cell.
- Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- **Microscopes help us see things we cannot see with the naked eye.**

BACKGROUND

All scientists use tools to help them make observations. *Micro* means small. Microscopes and magnifying glasses help biologists and other scientists see things that cannot be seen by the naked eye. Microscopes date from the 1600s. Jan and Zacharias Janssen, two Dutch spectacle makers are credited with developing the compound microscope. Galileo also made a microscope through which he observed insects.

A microscope usually has an eyepiece and one or more lenses. Magnification is an important feature of a microscope. The total magnification of a microscope is determined by multiplying the magnification of the eyepiece by the magnification of the other lenses.

The light microscope is very important in the study of biology. In a light microscope the light passes through the object and then through two or more lenses.

Stereomicroscopes are used for observing large objects that light cannot pass through.

Electron microscopes, first developed in the early 1930s, use a beam of electrons instead of light to magnify objects.

There are two basic kinds of electron microscopes. Transmission electron microscopes produce an image by passing a beam of electrons through the specimen. Scanning microscopes form an image by scanning the surface of a specimen with a beam of electrons.

MATERIALS

- magnifying glasses, *bug* boxes, microscopes
- petals of flowers, hair, mold, newspaper with colored print, sugar and salt
- cork
- copies of page 11 or 12

PROCEDURE

1. Give each student a scrap of newspaper with colored letters on it and a copy of page 11 or 12. Have students draw what they see without any magnification.
2. Repeat process using magnifying glasses, *bug* boxes, and microscopes. Remind students that they will be drawing only a portion of the whole.
3. Repeat steps 1-2 using flower petals, hair, sugar, salt, and mold.
4. Have students suggest other items for observations. Encourage students to observe as many items as possible and record observations. Repeat process using their suggestions.

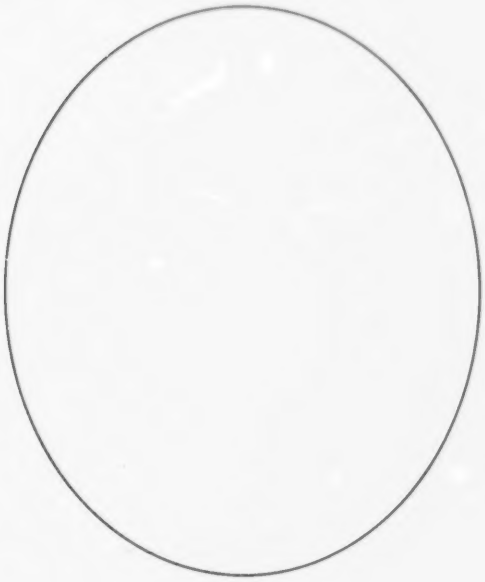
EXTENSION ACTIVITIES

- Research what other types of tools biologists use to help them make observations.
- Research tools other scientists use.
- Research the lives of: Anton van Leeuwenhoek, Galileo, Jans and Zacharias Janssen, Robert Hooke.
- To see what Robert Hooke saw, slice a thin section from a piece of cork and look at it under a microscope.

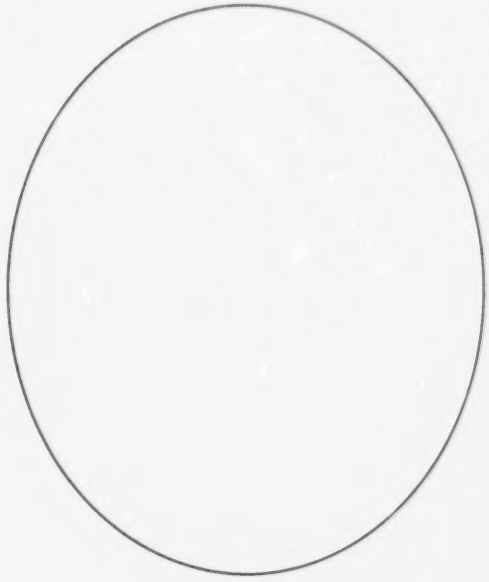
OBSERVATIONS

Specimen _____ Biologist's Name _____

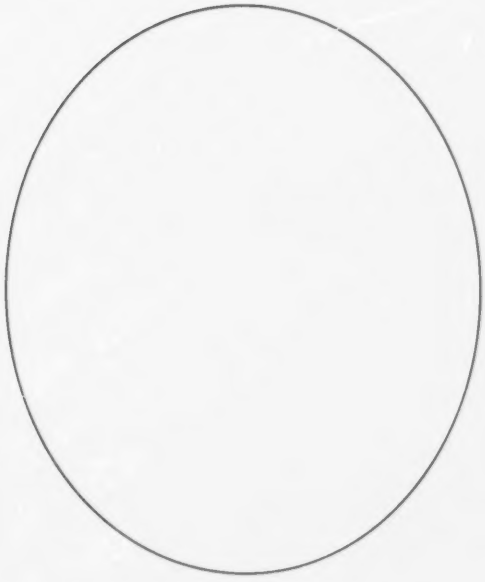
Date of Observation _____



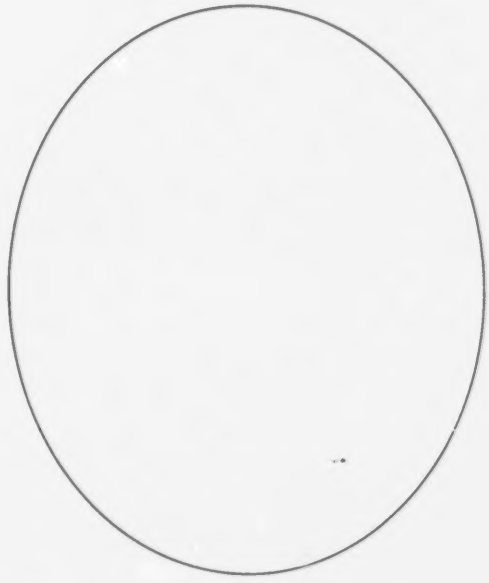
Naked eye



Magnifying Glass



Tool used?_____

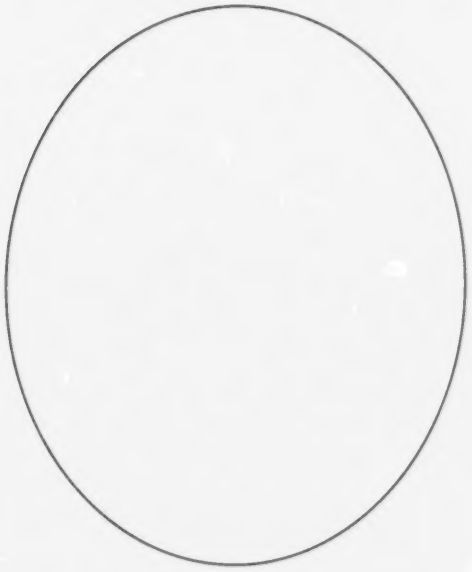


Tool used?_____

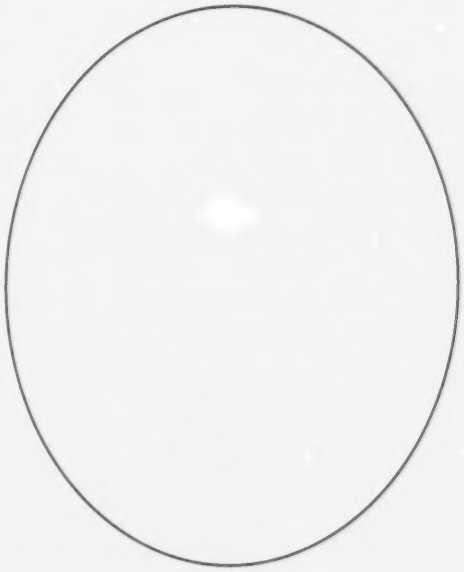
OBSERVACIONES

Especimen_____ Nombre del biologo_____

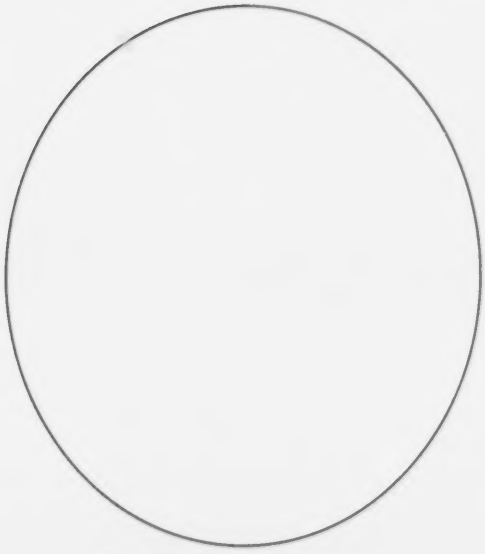
Fecha de Observación_____



A Simple Vista

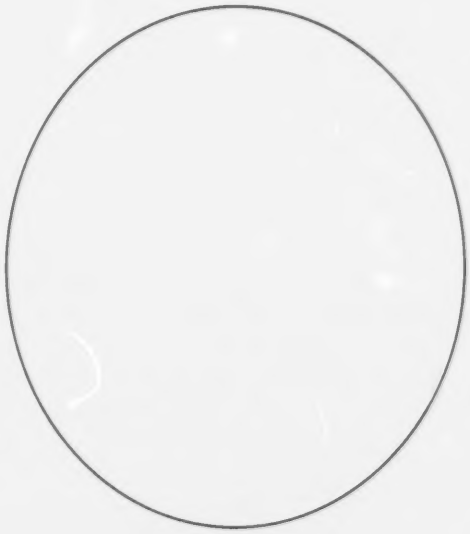


Lente de Aumento



Instrumento Empleado

_____



Instrumento Empleado

_____

INVITATION 3

PLANT AND ANIMAL CELLS

CONCEPTS

- Some living things consist of a single cell.
- **Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.**
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- **Microscopes help us see things we cannot see with the naked eye.**

BACKGROUND

Plants and animals are made up of many cells. A cell is the smallest unit that carries on all the activities of life. Most cells are surrounded by water. Water is also present inside the cell. Water is integrally responsible for the shape of the cell membrane.

There are basically two kinds of cells: eukaryote cells contain a nucleus, prokaryote cells do not. Fossils show evidence of many prokaryote cells. The only prokaryotes alive today, as far as is known, are the bacteria.

In this INVITATION, the purpose is to have students actually observe plant and animal cells through a microscope, and to provide an opportunity for students to see cells first hand. It is important for students to begin to develop their own schema for the differences between animal and plant cells. Some students may believe a cell wall and a cell membrane are the same. Help students distinguish between the two. Cell membranes control what moves into and out of the cell, but cell walls do not. Some cells of fungi and some one-celled organisms also have cell walls.

Plant cells may contain chloroplasts in the cytoplasm. Chloroplasts are the cell parts that contain chlorophyll, the green pigment that gives plants their color. Chlorophyll traps energy from the sun from which plants make food.

The smallest single-celled animal has the same needs and requirements to survive as the most complex animal that walks this earth. Needs that are important for humans, such as breathing, obtaining food, and successfully reproducing, are also important to the single-celled organism. These functions are carried out in organelles, tiny cell structures which have a particular function.

MATERIAL

- a variety of magnifying tools, microscopes, if possible
- slides of, or pieces of, onion membrane (found between layers)
- lettuce
- elodea leaves
- skin from inside cheek
- pond water
- copies of pages 15-18
- science magazines that can be cut up
- iodine

PROCEDURE

1. Brainstorm as a class, the similarities and differences between plants and animals using a Venn diagram.
2. Using the membrane of an onion and different magnifying tools, have students diagram what they observe. Depending on the students, you may want to make up the slides for them using ink or other dye to help highlight the cell parts. Older students, if careful, can make up their own slides.
3. Repeat with lettuce and elodea leaves.
4. Repeat with sample of tissue taken from the inside of your cheek. Have students diagram what they observe.

5. Repeat with pond water.
6. In small groups, have students create Venn diagrams, page 17, showing differences and similarities between the plant and animal cells.
7. After students have had ample opportunity to develop their own sets of similarities and differences, tell students that most plants have cell walls that help with structure and most plants have chlorophyll which makes plants green and is a way for the plants to get energy from the sun.

EXTENSION ACTIVITIES

- Research the life stories of Robert Hooke, Lorenza Ohen, Matthias Schleiden, Theodor Schwann, Lynn Margulis, Rita Levi-Montalcini, Oscar Schotte.
- Have students find pictures of cells in science magazines and make a bulletin board display. Include some of the student's drawings and observations.

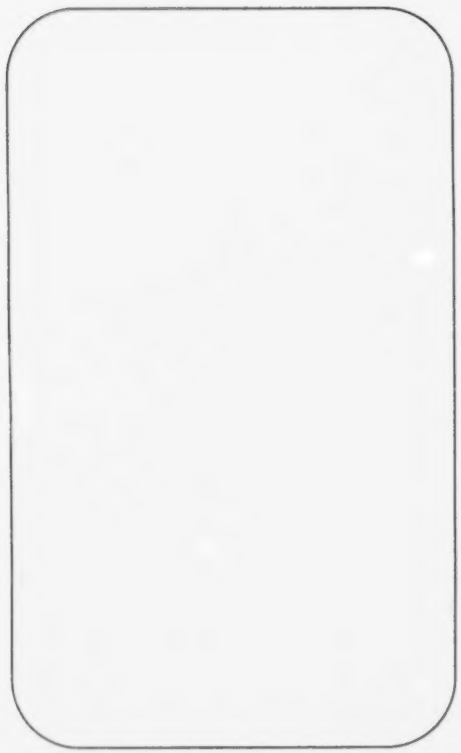
HOW TO PREPARE CHEEK CELL SLIDES

1. Put a drop of iodine solution on a slide.
2. **Gently** scrape inside of your cheek with a toothpick.
3. Stir end of toothpick in the drop of solution on the slide.
4. Too many cheek cells on the slide will make it difficult to see single cells
5. Add a cover slip.
6. Look at slide under a microscope.

PLANT CELLS

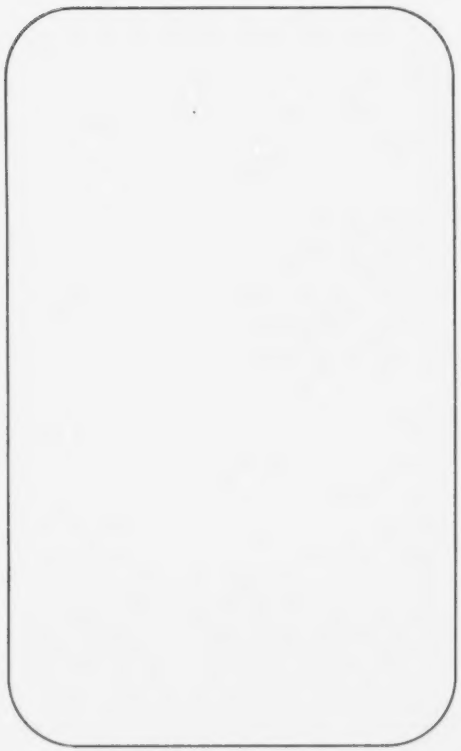
CÉLULAS DE PLANTAS

Biologist
Biólogo_____



Onion Membrane
Membrana de Cebolla

21



Elodea
Elodea

Lettuce
Lechuga

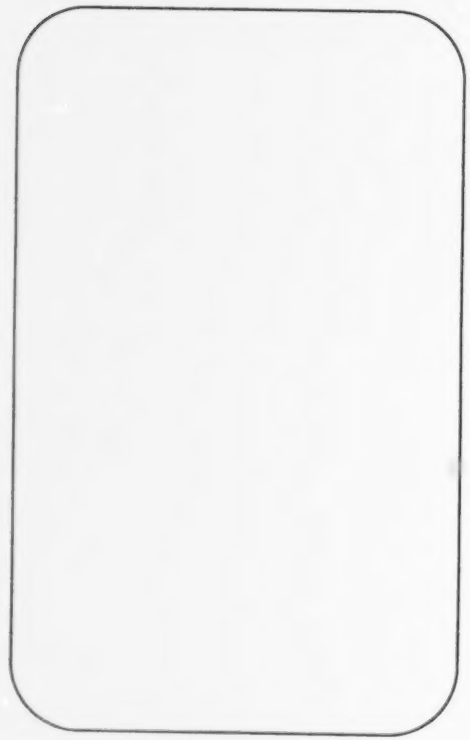
22

ANIMAL CELLS

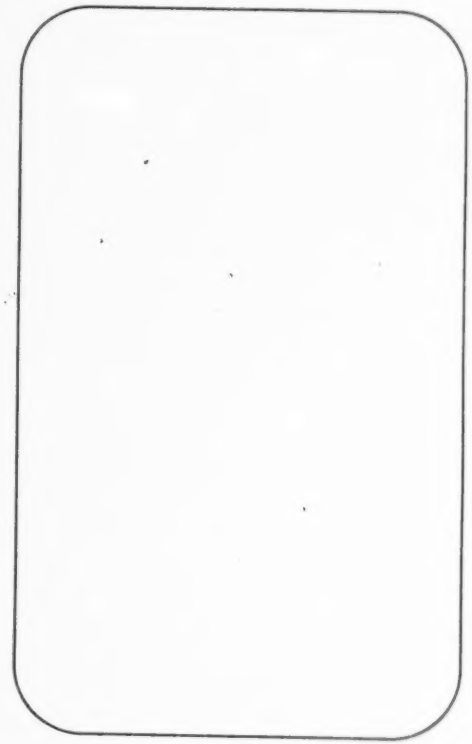
CÉLULAS DE ANIMALES

Biologist
Biólogo_____

Cheek Skin
Epidermis de la Mejilla



Pond Water
Agua de Lago

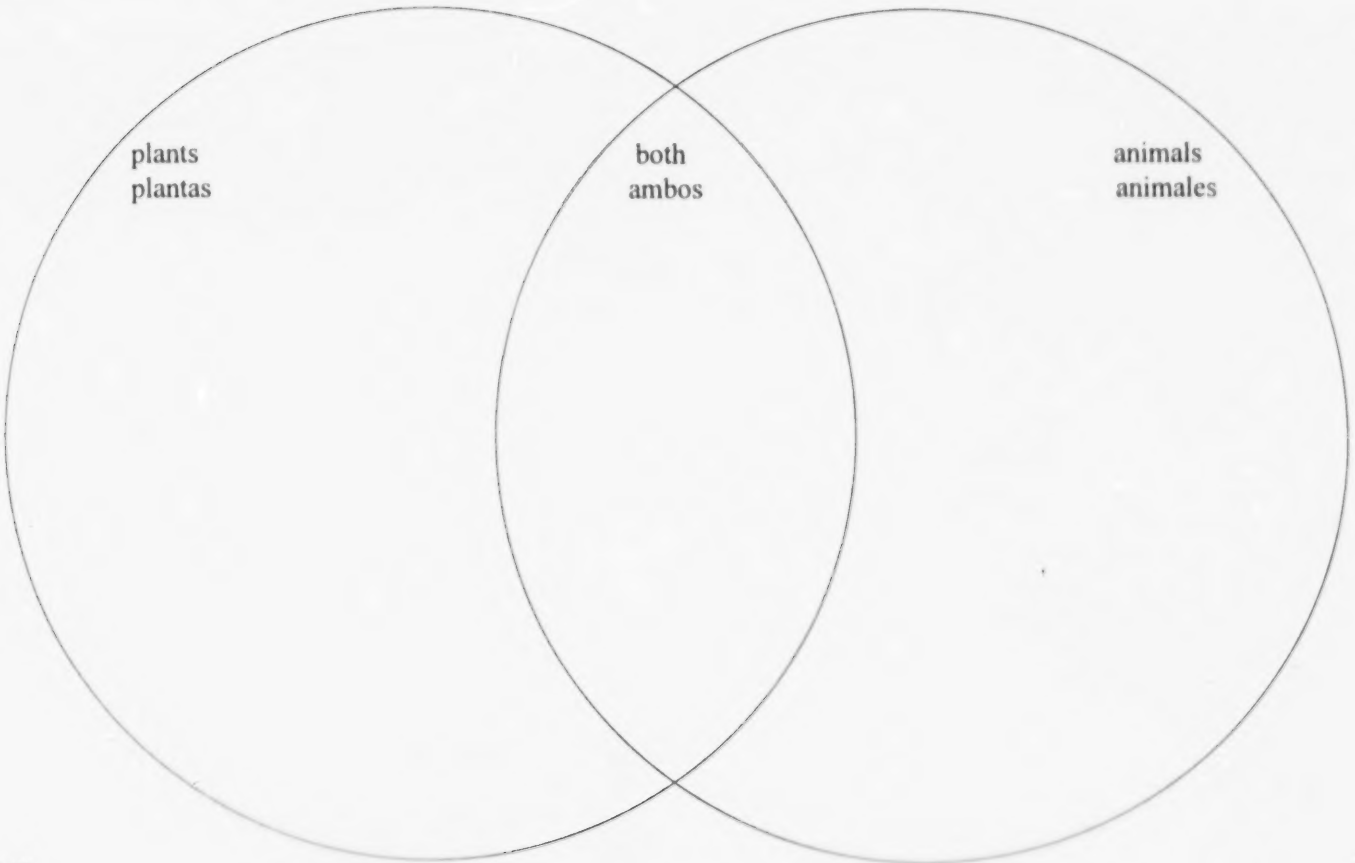


Pond Water
Agua de Lago

PLANT AND ANIMAL CELLS

CÉLULAS DE PLANTAS Y DE ANIMALES

Biologist
Biólogo_____



SIMPLE DIAGRAMS OF A TYPICAL PLANT AND ANIMAL CELL
DIAGRAMAS SIMPLES DE UNA CÉLULA TÍPICA DE PLANTA Y DE ANIMAL

PLANT CELL
CÉLULA DE PLANTA

ANIMAL CELL
CÉLULA DE ANIMAL

INVITATION 4

IT'S ALL HERE

CONCEPTS

- **Some living things consist of a single cell.**
- **Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.**
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

The major difference between a single-celled organism, such as paramecium, and us is that we are made up of billions of cells, and paramecium only have one. Even though this is a major difference, both must carry out the same functions in order to survive. The paramecium, like us, needs to eat, move, remove waste, reproduce, and most of all, survive. For example, in a paramecium the food is taken in by a cilia-lined gullet.

MATERIALS

- A large chart similar to page 20 or 21 for the bulletin board
- Copies of page 20 or 21 for each student
- Large version of the paramecium and its parts from colored paper or felt as a demonstration model, page 22; labels for each cell part, page 23
- A set of paramecium parts and labels from stiff laminated paper for each group of students. Colors of student's sets should match demonstration model.

PROCEDURE

1. As a class, brainstorm what living things need in order to stay alive. Waste removal and reproduction may be sensitive issues, use your discretion about how to handle these functions. Have students record the refined list in the first column of the chart on page 20 or 21.

2. In groups of three or four, have students help each other fill out columns two and three of the chart. Share results with class. As students clarify and agree on what part of the animal or plant is responsible for each given function, record results on large chart.

3. Explain to students that almost all organisms have to be able to perform the functions listed in order to stay alive, even if the organism is the size of one cell.

4. Introduce the paramecium and its parts. Construct and label it on the bulletin board. As you identify and discuss the function of each part, have students copy your process, filling in their chart as they go along. NOTE: The students do not need to memorize the names of the parts of the cell. They only have to come to understand that almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.

5. Repeat step 4 using picture of euglena pages 23 and 24.

EXTENSION ACTIVITIES

- Have students find pictures of animals or plants that perform the necessary functions of life in an unusual way. In journals reflect on the advantages and disadvantages to these particular adaptations.

LIFE FUNCTIONS

Scientist_____

In the column labled FUNCTION, list all the activities an organism must be able to do in order to stay alive. In the columns marked ANIMAL and PLANT, name the part of the organism responsible for carrying out that activity.

FUNCTION	ANIMAL	PLANT	PARAMECIUM
Needs to eat or get food	Mouths	Roots	

FUNCIONES DE VIDA

Científico_____

En la columna llamada FUNCIÓN, enumere todas las actividades que un organismo debe llevar a cabo para poder sobrevivir. En las columnas llamadas ANIMAL y PLANTA, nombre la parte del organismo responsable para llevar a cabo cada actividad.

FUNCIÓN	ANIMAL	PLANTA	PARAMECIO
Nececita comer o obtener comida	Bocas	Raíces	

Paramecium Parts

34

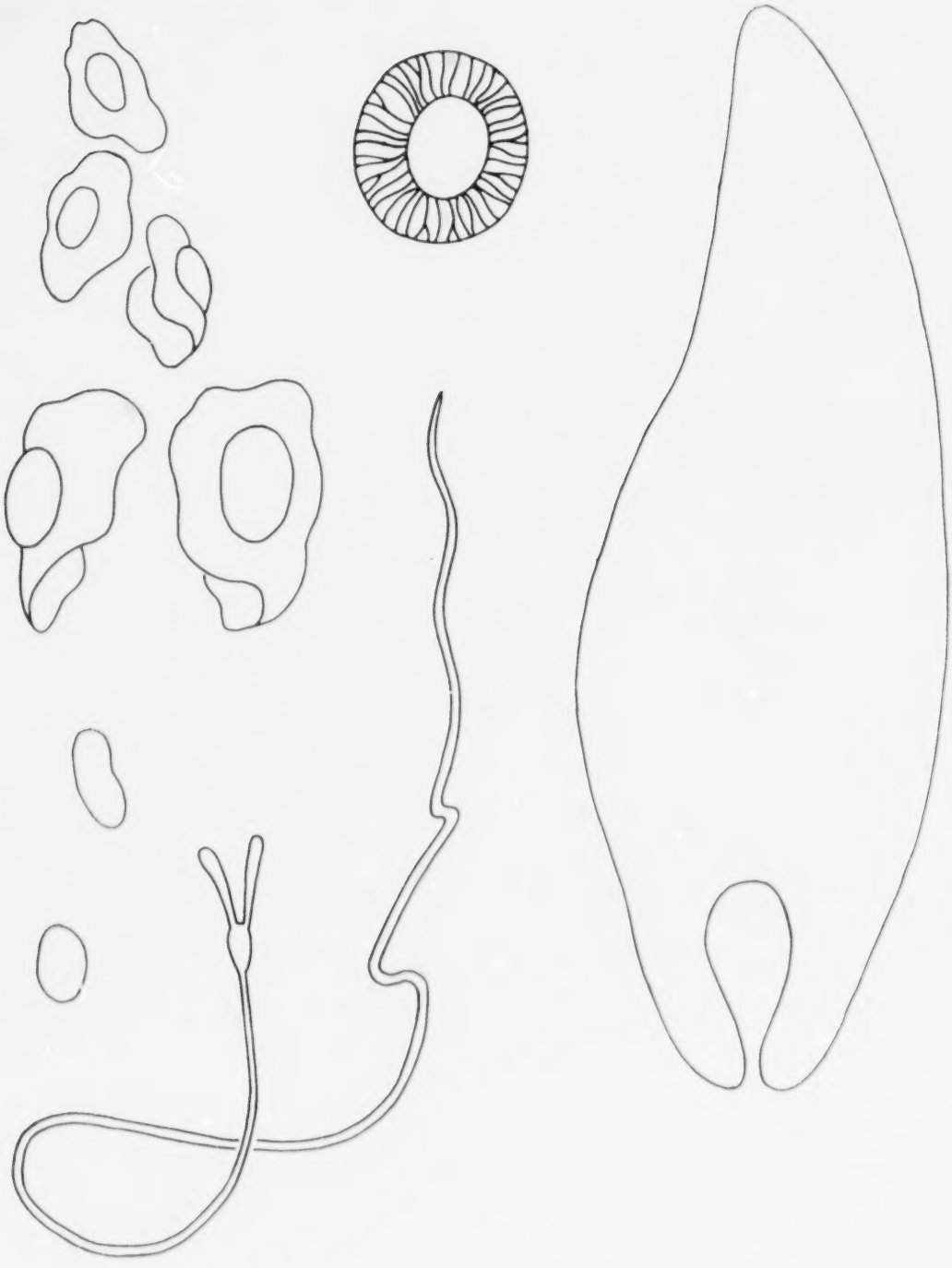
33

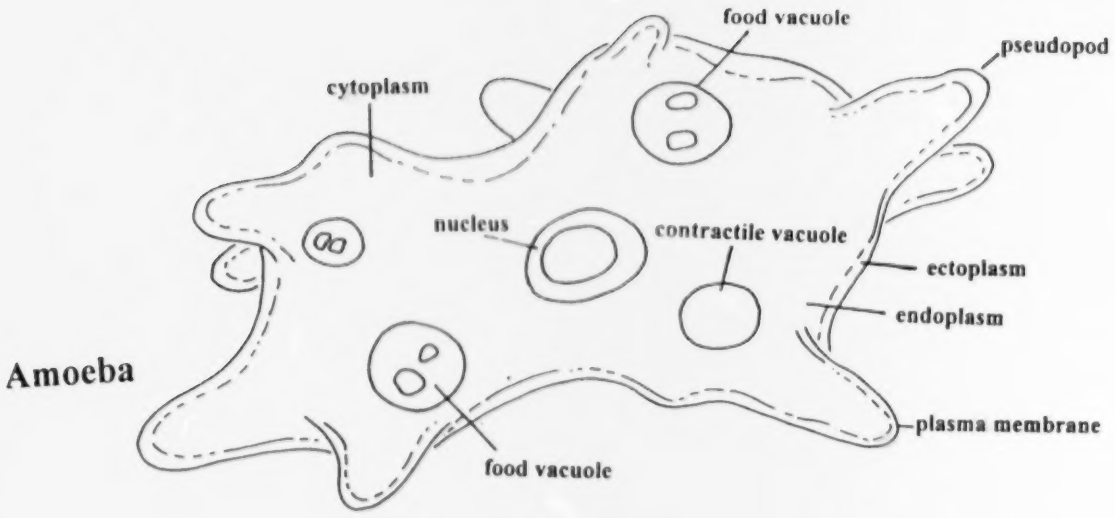
Paramecium
nucleus
micronucleus
cell membrane
water vacuole
gullet

cilia	waste
food	mouth

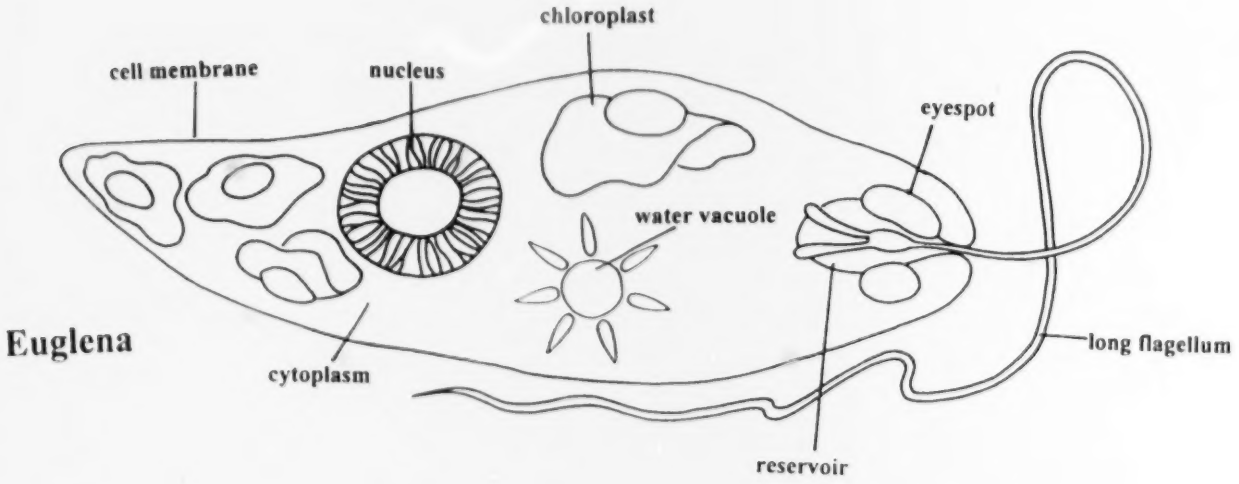
Euglena
cell membrane
chloroplast
water vacuole
eyespot
long flagellum
nucleus
reservoir

Euglena Parts

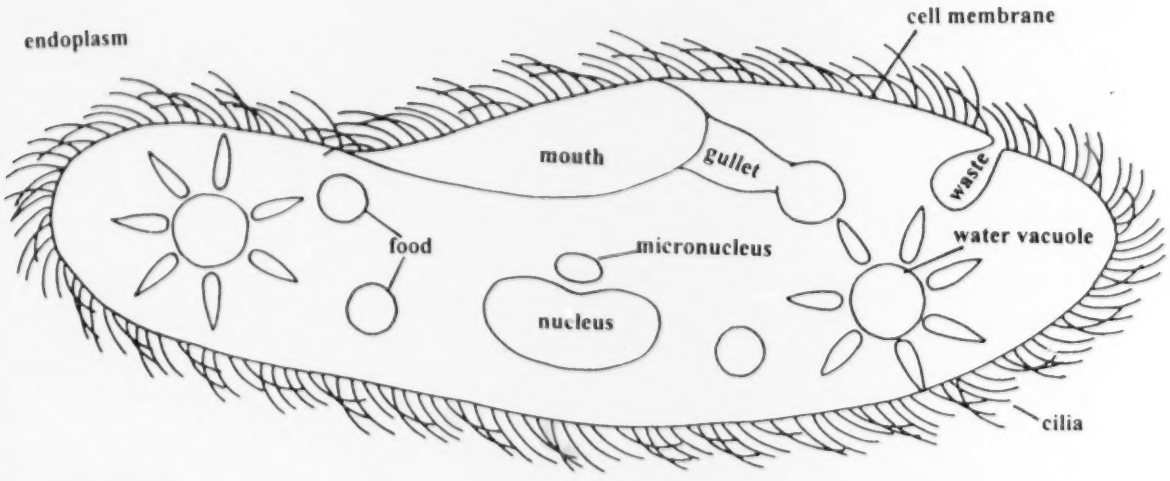




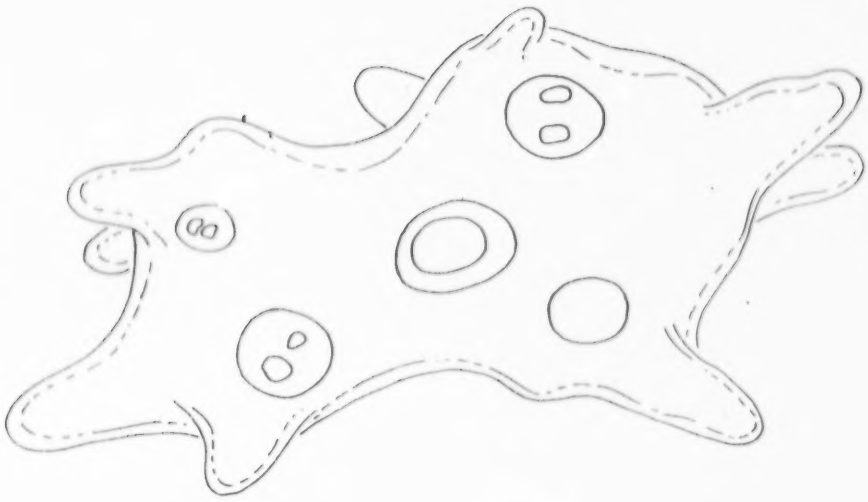
Amoeba

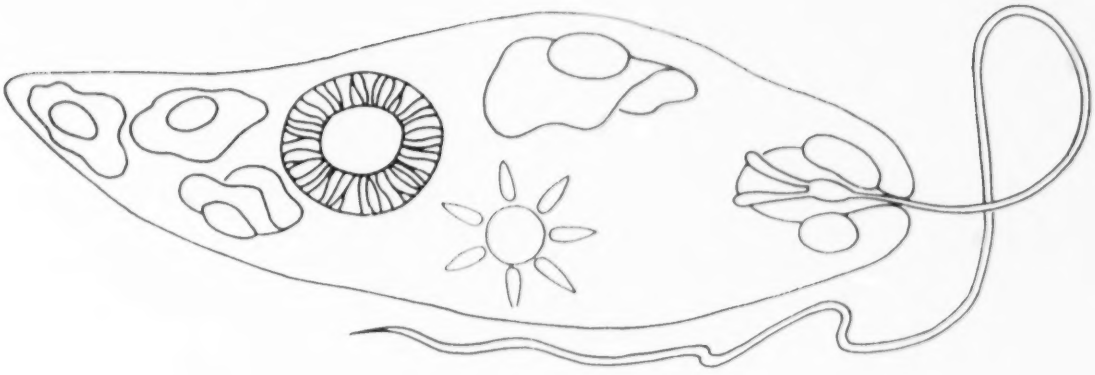


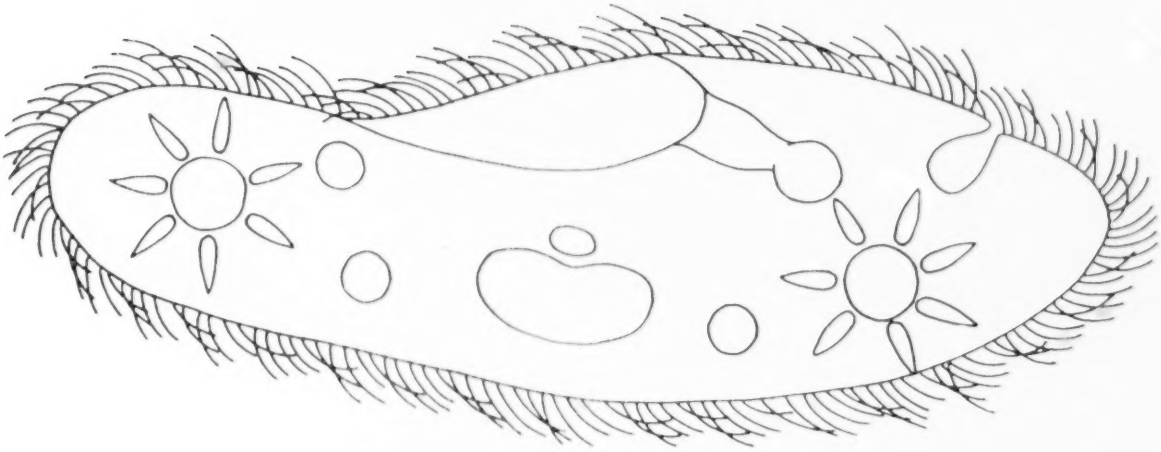
Euglena



Paramecium







INVITATION 5

CREATE-A-CELL

CONCEPTS

- **Some living things consist of a single cell.**
- **Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.**
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

NOTE: This invitation is best done after Invitation 4.

The smallest single-celled animal has the same needs and requirements to survive as the most complex animal on the earth. Needs that are important for humans, such as breathing, obtaining food, and successfully reproducing, are also important to the single-celled creature. Remember organisms also need an environment in which they can survive.

MATERIAL

- Art supplies

PROCEDURE

1. As a class, review what living things need in order to stay alive. Waste removal and reproduction may be sensitive issues, use your discretion about how to handle these functions.
2. Stress that all living things have the same requirements that have been listed. Invite students to sketch an imaginary one-cell organism that is capable of performing all of the needed functions. Have students create names for each part of the cell.
3. In pairs have students check each other's sketches to make sure all the functions necessary are identified.
4. Invite students to make small (smaller than a bread box) three-dimensional models of their single cell organisms.
5. Group organisms by environments. For example, gather all the organisms that need to live in fresh water together in one part of the room. Have students in that group create the appropriate environment and place their single-cell organism in it. NOTE: You may want to assign environments first so that there are an equal number of students in each group.
6. Have each student name their single-cell organism.
7. Have each group write a story about the single-cell organisms represented in their group.

EXTENSION ACTIVITIES

- Have students create a tape of sounds that enhances the environments in steps #5.
- Collect stories and illustrations created in step #7. Produce a bound book. Give a copy of the book to the school library.

INVITATION 6

ON THE MOVE

CONCEPTS

- **Some living things consist of a single cell.**
- Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- **Microscopes help us see things we cannot see with the naked eye.**

BACKGROUND

Most living things need to move around. If they do not, survival is more difficult because they have to wait for food to come to them. Plants, the largest group of organisms, do not need to move because sunlight, their energy source, is available.

Protists are mainly single celled organisms that are capable of movement. This movement is called locomotion. These protists are called motile. Most plants are not motile. Many animals are also not motile, for example, coral and barnacles. These animals are stationary or sessile.

Being able to move offers the advantages of being able to obtain food, find places to live, move away from harmful conditions, escape from enemies, and find mates.

Living things move in a variety of ways. In all but the simplest organisms, organisms move by using muscles and a skeleton. Among the motil forms of protists, locomotion is accomplished by pseudopods, cilia, or flagella.

Pseudopods are temporary projections of the cell surface. The organisms move by a flowing of cytoplasm into the projections. Amoebas move this way.

Cilia are short hair-like organelles on the surface of a cell with the capacity for movement. In paramecia these cilia act like oars propelling them through the water.

Flagella are similar to cilia only longer and are limited to one or two. The whiplike movement of the flagellum pull the organisms through the water. Euglena have one flagellum.

MATERIALS

- Pictures of organisms from magazines or copies of pages 30 and 31 enough so each student has several different pictures
- Microscope or other magnifying tools
- Copies of page 32 for each student
- Pictures of single-cell organisms from magazines or copies of page 26
- Pond water

PROCEDURE

1. Give a set of organism pictures to each group of 3 or 4 students. Have students list how these organisms move from place to place and how their bodies have developed to accomplish this function.
2. Give students a set of pictures of single-celled organisms that have the following organelles: flagellum, cilia, and pseudopod. Discuss with students how these organisms move from place to place and how their bodies have developed to accomplish these functions.
3. Have students observe actual cells, either through a microscope, video, or laser videodisk. If these resources are unavailable, use pictures on page 26.
4. Have students develop a new form of cell locomotion by observing things that they see everyday. Discuss how these forms of locomotion are used in industry, toys, and many objects used in daily life.
5. Invite students to write a story about this new creature and its form of locomotion.

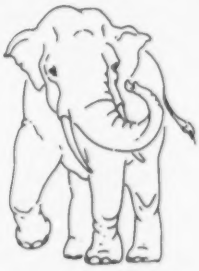
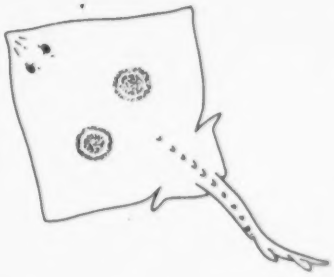
EXTENSION ACTIVITIES

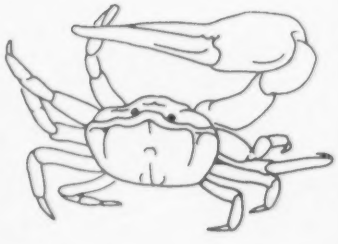
- Play Amoeba Follow The Leader.

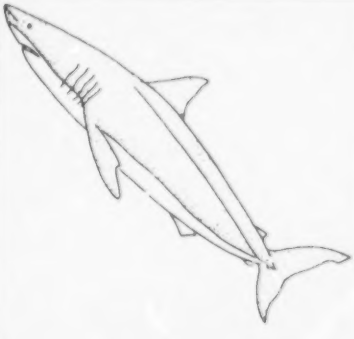
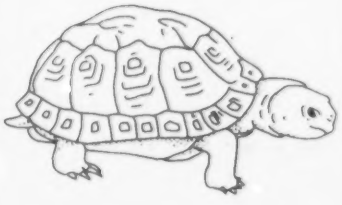
Have students hold hands in groups of 5 or 6. Tell students that each group is an amoeba, and they are going to play follow the leader. You will have to set some boundaries. For example, it is very difficult to climb a tree as an amoeba. Give each group a turn to go first.

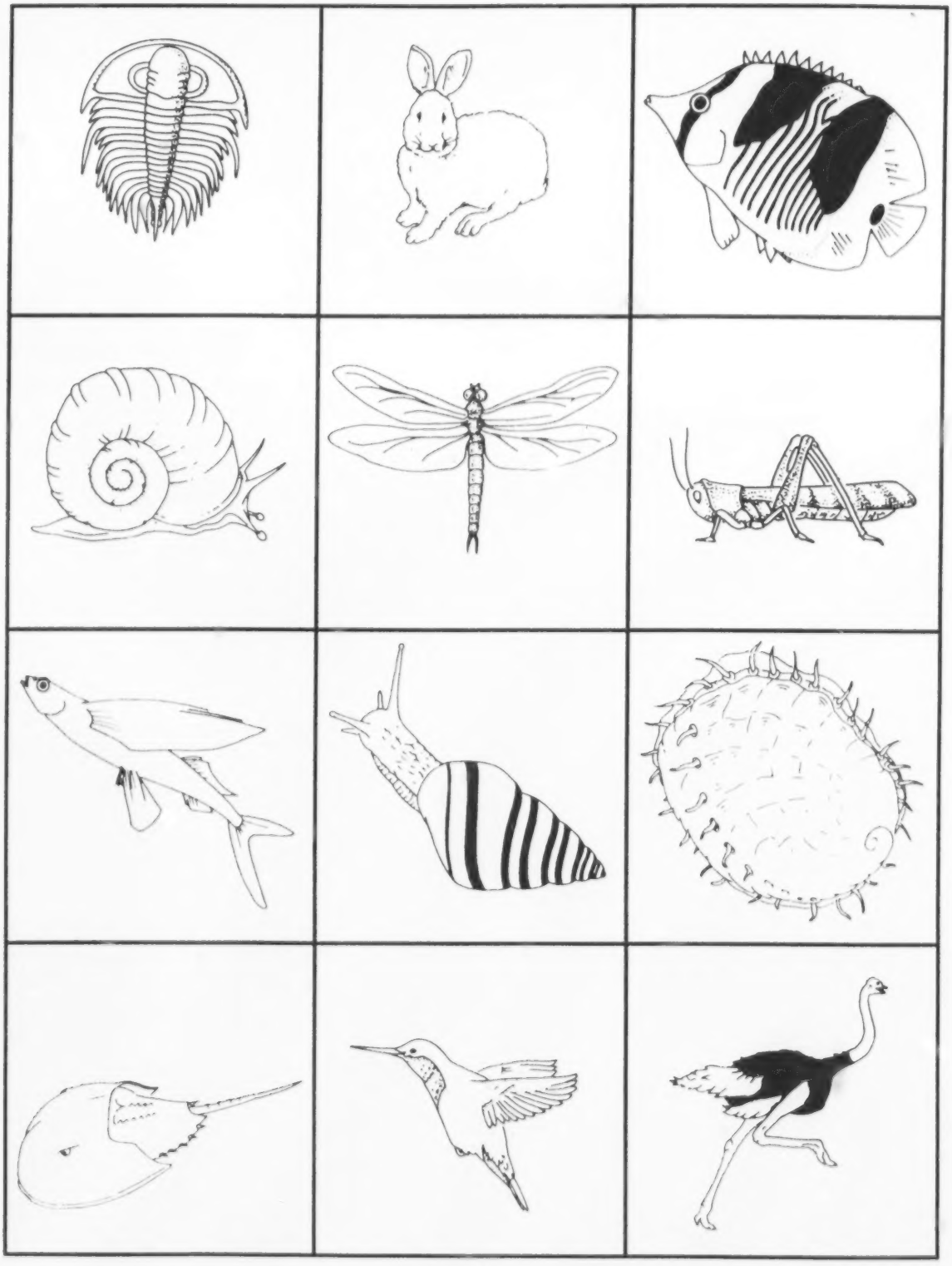
ALTERNATIVE: Make circles of rope about three feet in diameter. Have students stand inside rope circle holding rope with both hands. Play follow the leader.

- Create other one-cell organisms using groups of students.





ON THE MOVE EN ACCIÓN

Scientist
Científico _____

ORGANISM ORGANISMO	Describe how the organism moves . Describe como se mueve el organismo:

INVITATION 7

PASSING THROUGH

CONCEPTS

- Some living things consist of a single cell.
- **Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.**
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

The cell membrane is an important part of the cell, comparable to our own skin. The purpose of the membrane, which appears to be a solid sheet that encases the cell, is to keep the outside out and the inside in. This division is necessary to the survival of the cell, but there also needs to be a means by which nutrients pass into the cell and wastes pass out of the cell. Without this process called osmosis, the inside of the cell would not be able to get the needed nutrients to maintain life. The same is true in the human body.

MATERIALS

- Large beaker or jar
- Zip-lock plastic sandwich bag
- Starch solution (corn strarch/water)
- Signs with FOOD on one side and WASTE on the other
- Iodine solution
- Water

PROCEDURE

1. Partially fill a large clear colorless container with water and a few drops of iodine. Record amount of solution.
2. Make a starch solution from cornstarch and water. Partially fill a plastic sandwich bag with the starch solution. Record amount put in bag. Save the rest for Step #8. Close top tightly. It is very important that the bag does not leak. NOTE: Test bag first. Rinse outside of bag with plain water and dry bag.
3. Invite students to feel and inspect the bag until they are convinced that the bag is not leaking.
4. Gently lower bag into iodine water. Do not submerge the top of the bag in the iodine water. This eliminates the possibility of leaking. You may have to tie the bag to a stic!.
5. Invite students to predict what might happen in a day, two days, a week.
6. Have students record observations for a few days.
7. At the end of the observation period, have students hypothesize about what happened. Why did the starch change color?
8. Show students the remaining starch solution. Place a few drops of iodine in the solution. Have students record observations of what happened.
9. Invite students to refine their hypothesis.
10. NOTE: Do this part in a large area. Tell students that they are to imagine magnifying the plastic bag and water solutions. Have some students stand in a circle, holding hands, far enough apart so one student can pass through under the arms, but close enough together so that a large number of students won't fit. They are the plastic bag. Have a few students outside the circle. They are iodine. Have about five students on the inside holding hands as wide as they can make their circle so they can not easily get out of the circle. They are starch. Try to arrange the students so that it is easy for the students outside the circle to move easily to the inside of the circle and

difficult for the group of students in the inside circle to move outside the big circle. After a while, explain to the students that there are spaces in the plastic bag large enough for water to pass through with the iodine, but too small for the water and the starch to pass through.

11. Repeat process, but this time have students hold food-waste signs. Have some students on the inside and some on the outside of the circle. Tell the students who were the plastic bag that they are now the cell membrane. They can only allow food into the circle and waste out of the circle. This is not so much a game as a simulation of the process of the cell membranes regulating the intake of food and the expulsion of waste. Students with signs can only move into the circle when they have the food sign showing. Students can only move out of the circle when they have the waste sign showing. The circle representing the cell membrane can move to *capture* food or *eliminate* waste.
12. Have students record their feelings and observations in their journals.

EXTENSION ACTIVITIES

- Invite students to design a board game that will help other students understand some of the concepts they have learned about cells.

INVITATION 8

A DAY IN THE LIFE OF CHRIS C. CELL

CONCEPTS

- Some living things consist of a single cell.
- **All organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.**
- Some organisms are made of similar cells that benefit from cooperating.
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

It is not necessary for the students to memorize the names of the cell parts. Use your discretion as to how many parts are to be included in the play. Older more mature students may be able to do all the parts. Younger more immature students may only be able to do four or five.

The **cell membrane** goes around the cell and gives the cell shape. It also controls what moves into and out of the cell. It is not a cell wall.

The **nucleus** controls most of the cell's activities.

The **nuclear membrane** surrounds the nucleus and allows materials to flow into and out of the nucleus.

A **nucleolus** helps make ribosomes and is located inside of the nucleus.

Chromosomes are structures in the nucleus that have the information that determines what traits a living thing will have. Chromosomes are only visible during cell division.

Cytoplasm is a clear, jellylike substance that is between the cell membrane and the nucleus. Cytoplasm is mostly water.

There is a network of canals in the cytoplasm that help move material around inside the cell.

Lysosomes are found within the cytoplasm. They contain digestive enzymes that help break down large molecules.

Ribosomes are the parts of the cell where proteins are made.

Another part of the cell found in the cytoplasm is the structure that packages and stores chemicals.

Also in the cytoplasm are rod-shaped objects called **mitochondria.** Mitochondria produce energy from food.

The digestive chemicals are contained in small sacs. These chemicals get rid of disease-causing bacteria, destroy worn-out cell parts, and form products that can be used again.

Vacuoles are spaces that store food, water, and minerals. They also hold the waste until the cell is ready to dispose of it.

Pairs of **centrioles** are responsible for cell reproduction.

MATERIALS

- Art supplies
- Costume parts

PROCEDURE

The purpose of the Invitation is to write a play entitled "A Day in the Life of Chris C. Cell." Remind students that the play they are to create will be an animal cell, so there will be no cell wall or chloroplasts. NOTE: If creating a play is too difficult for your students, you may want to have them do "skits."

1. Group students according to the number of cell parts you think is appropriate for your class. (4-13)
2. Have each group of students select one cell part that they want to research and be in the play.
3. When the research is completed, have students write a play about "A Day in the Life of Chris C. Cell."

4. If your students have not studied the genre of plays, help them by showing how other plays are written. For example, be sure to have them include stage directions, setting, acts, scenes. You may want to limit the number of acts and scenes.

5. For example, the nucleus controls the cell, so its personality would be very bossy and always giving directions, the food vacuoles would only care about getting food and when it is time to eat, etc. Try to make the scenes as real as plausible, but funny also.

6. Produce plays including costuming, scenery, etc.

7. Perform plays.

EXTENSION ACTIVITIES

- Write the plays on computers with the help of a word-processing package. Bind and give to the school library.
- Invite other classes or parents to the performance.

INVITATION 9

LIVING IN THE COLONIES

CONCEPTS

- Some living things consist of a single cell.
- Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.
- **Some organisms are made of similar cells that benefit from cooperating.**
- Cells vary in appearance and function.
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

As organisms become more complex, their structures are organized in more complex ways. Colonial organisms are single-celled organisms that have gathered together in colonies. The cells in colonial organisms are not related in many ways.

Sponges are a good example of colony living. When the cells come together some specialize by becoming the outer layer and forming a protection for the colony, while those on the inside constantly move water through the cell in order to keep the food supply available. However, each cell can live independently if it has to, unlike a muscle cell in more complex organisms that cannot survive on its own.

MATERIALS

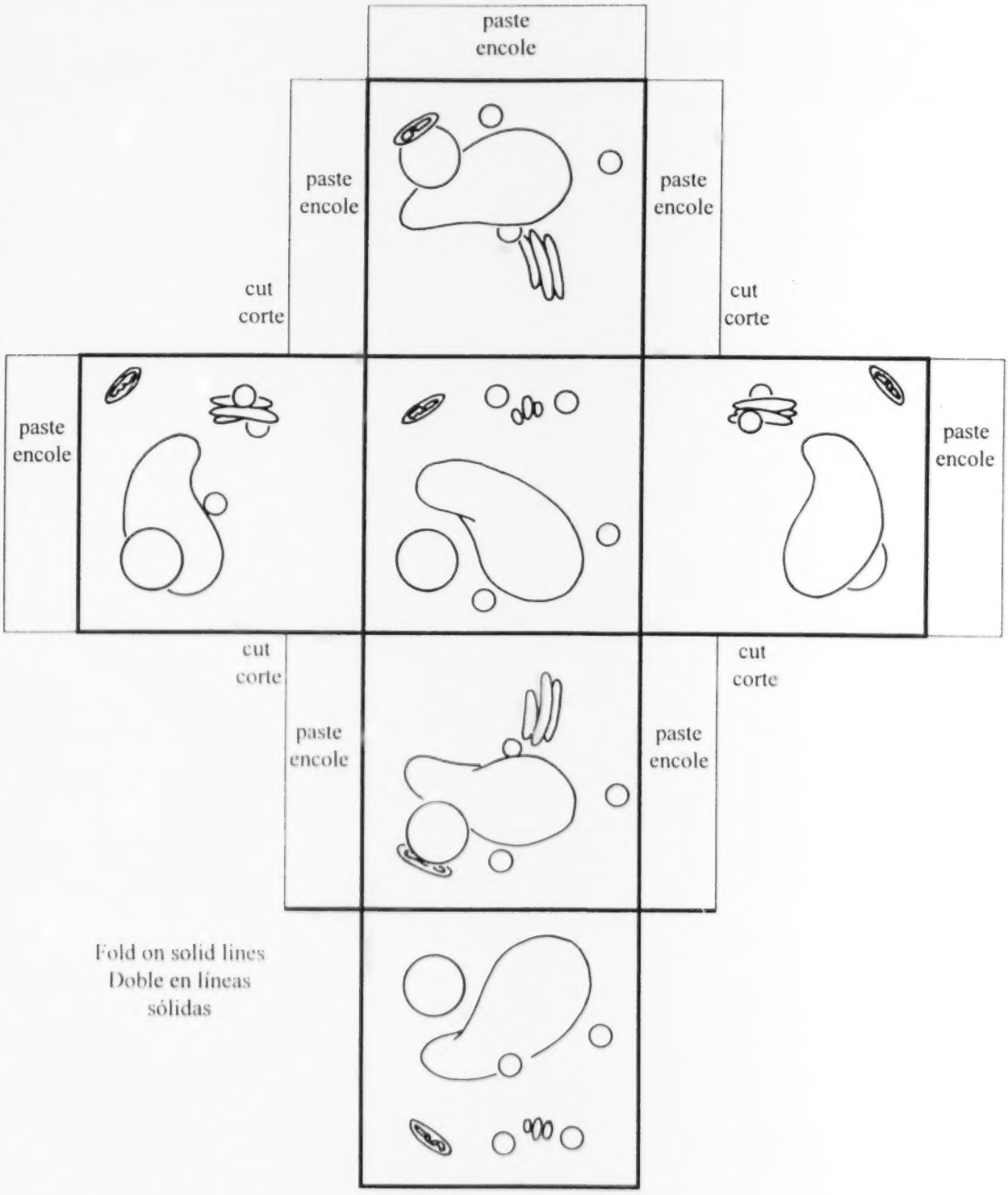
- A copy of page 38 for each student
- Arts and crafts supplies
- Live sponges (optional)

PROCEDURE

1. Have each student color in the parts of the cell on page 38 and construct the cell. Remind students that this is only a rigid model of a cell.
2. Explain to the students that some cells live together, but only cooperate for some activities, very much like people living in an apartment house. The people living in each apartment do all of the functions necessary for life.
3. After students have constructed their cells, build an "apartment house" of the cells. Glue them together. They do not need to be blocked in any regular way.
4. If you have access to real sponges, show students the sponge and explain that the sponge is really hundreds of cells living together.
5. If you have access to "live" sponges, push the sponge through a fine sieve into a container of water.
6. Observe what happens. NOTE: The individual pieces of sponge will eventually come back together to form a colony.

EXTENSION ACTIVITIES

- It is also possible to demonstrate this concept using gelatin in ziplock bags. Have students suggest food items that they can use to simulate parts of the cell. For example, slices of banana for the nucleus, raisins for waste, shredded carrots for ribosomes. Put gelatin and simulated parts in plastic bags. Find a creative way to arrange the gelatin cells when gelatin has jelled. The students may want to eat the cells after the demonstration.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INVITATION 10

WHAT DOES WHAT?

CONCEPTS

- Some living things consist of a single cell.
- Almost all organisms regardless of size and complexity need food, water, air, a way to dispose of waste, and an environment in which they can survive.
- Some organisms are made of similar cells that benefit from cooperating.
- **Cells vary in appearance and function.**
- Microscopes help us see things we cannot see with the naked eye.

BACKGROUND

Multicellular organisms are different from colonial organisms in that the cells begin to specialize. Different kinds of cells perform different functions.

Tissue, such as muscle, nerve, and bone, is a group of cells that are alike in structure and activity. Muscle tissue, for example, specializes in motion.

In the human body for example, there are four different kinds of tissues.

Epithelial tissue is made up of flat sheets of tightly connected cells. Skin is an example of epithelial tissue.

Muscle tissue is responsible for the movement in a body including moving blood and food. Muscle tissue cells contract and lengthen.

Nerve cells are able to generate electrical impulses to other cells. Some nerve cells are meters long.

Connective tissue includes tendons, bones, cartilage and blood. Most connective tissue consists of fluid and fibers.

An **organ** is made up of several tissues working as a unit. A heart, brain, or tree trunk are organs that are made up of a variety of tissues.

MATERIALS

- Arts and crafts supplies

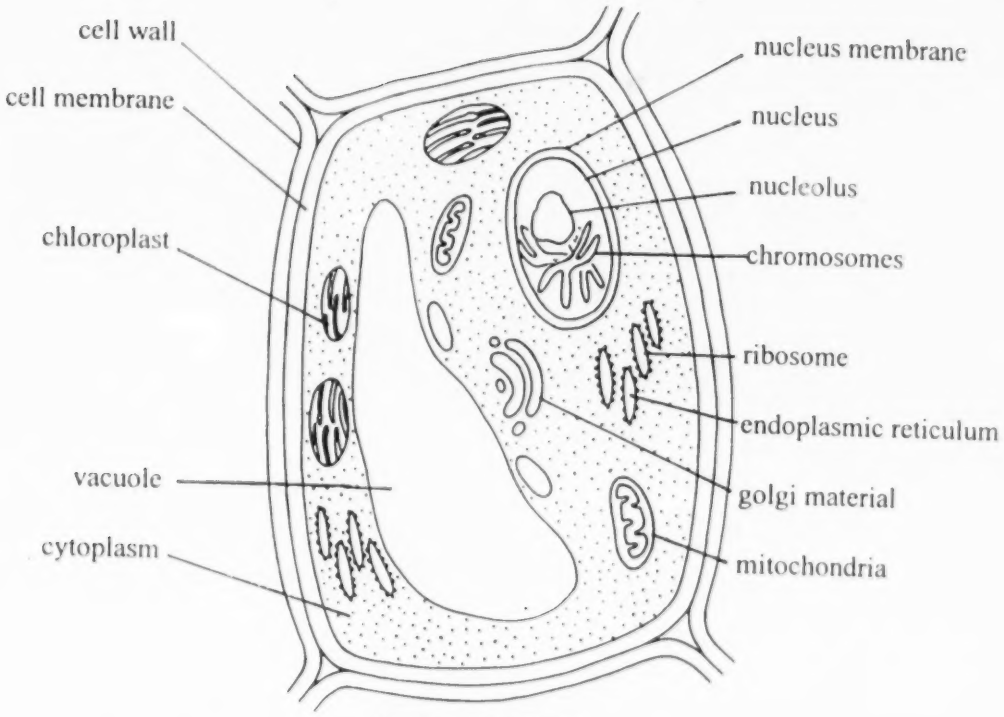
PROCEDURE

1. Assign students to one of the four basic kinds of tissue: epithelial, muscle, nerve, connective.
2. Group students according to the tissue they have been given. Have students research what the tissue looks like and the function that this tissue performs.
3. As a group, create three dimensional cells. Encourage students to simulate what actual cells of their tissue type look like.
4. Glue similar cells together to form tissue.
5. Create organs by gluing the tissues together.

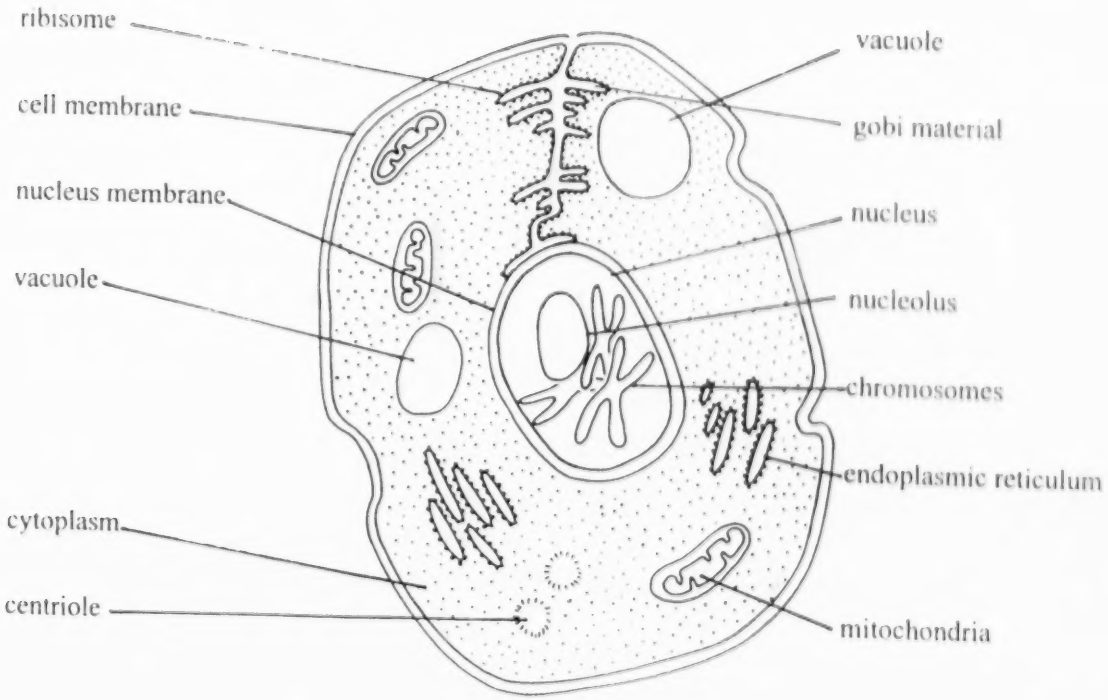
EXTENSION ACTIVITIES

- Turn the classroom into the inside of a human body using models of tissue created by students. Invite students from another class to "Go on an Adventure in the Human Body."

Plant Cell



Animal Cell



MY

SCIENCE

JOURNAL

Scientist's Name_____

MI

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CIENCIA

Nombre del Científico_____

Journal Thoughts and Ideas
Invitation_____

Books I've read on this topic

Today I learned...

Cuaderno de Ideas
Sugerencias_____

Libros que he leído sobre este tema.

Aprendí hoy . . .